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Trailing the Trilobite

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Introduction

Rocky ledges jutting forth to form stony outcrops along Iowa's streams, roadcuts and hillsides provide evidence of ancient environments entirely different from the rolling prairies of today. These rocky ledges were laid down in the bottoms of vast shallow seas which covered most of Iowa in its past history. Over great lengths of time, the waters swept back and forth, rising and subsiding, leaving a record in the layers of the earth's materials deposited in their depths. As the seas rose and fell, the deposits buried one another and became layers of conglomerate, sandstone, shale and gypsum. Minerals of calcite, dolomite, pyrite, galena glauconite and many others formed in these strata. Fossil remains of the plants and animals which lived in these environments left a record of life that flourished in these early seas. One distinctive form of animal life was the trilobite.

Trilobites were a group of arthropods (Fig. 1) found in marine sediments throughout the world. As a group they reached their apex of

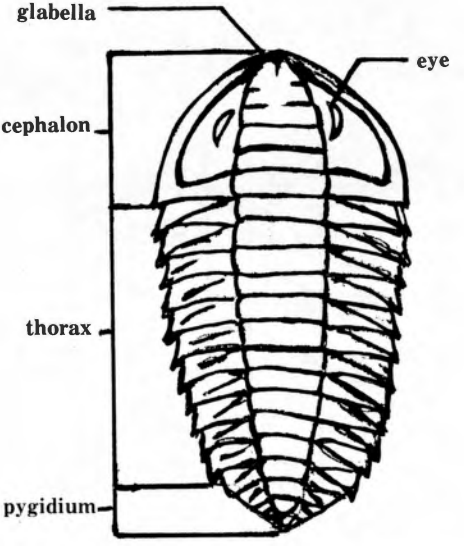

Fig. 1. Generalized diagram of a trilobite.

development during Ordovician and Silurian times. Their closest living relatives are crustaceans. Some trilobites lived on the sandy, muddy

bottoms of warm, shallow seas. Others were associated with coral reefs and still others were thought to inhabit deep marine environments. The first trilobites left their trails on the sea floor. From this beginning, some diversified to become active swimmers or passive floaters. Most trilobites probably fed on organic detritus and/or small organisms. There are no living trilobites known today.

A review and reconstruction of the sea deposits represented by outcrops in Iowa will not only provide the necessary background in following the trail of the trilobite but will also assist in understanding the environmental conditions in which they lived. Figs. 2 and 3 indicated

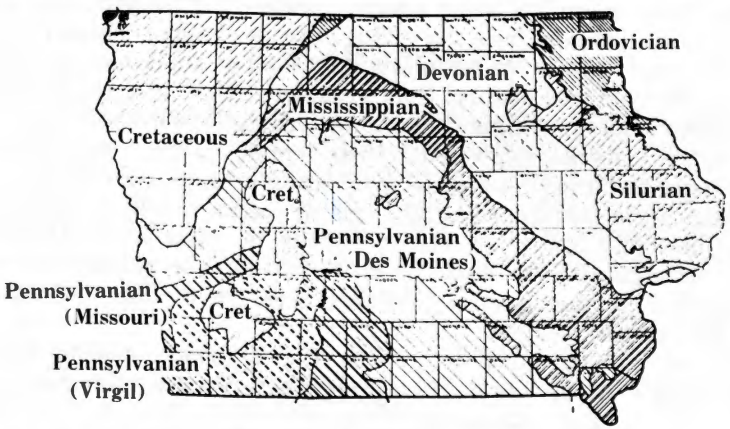

Fig. 2. Structural map of Iowa geology (glacial overburden not shown). (Courtesy of Iowa Geological Survey)

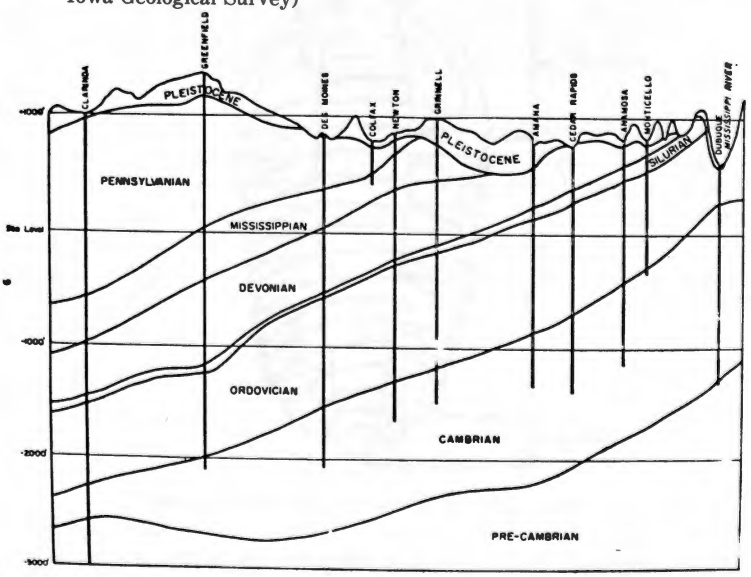

Fig. 3. Cross-section of Iowa geologic strata. (Courtesy of Iowa Geological Survey).

that ancient sea deposits in Iowa tend to dip toward the southwest and in general, as one journeys from northeast to southwest across the state, one moves from older to younger geologic strata.

Before the Trail Begins

The oldest sedimentary rock in Iowa is a hard, pink, siliceous rock in extreme northwest Iowa called Sioux quartzite. This rock is of Precambrian age. Sioux quartzite represents a marine deposit over one billion years old. The Sioux quartzite started out as water-laid sand deposits. In some places, crossbedding indicates that the deposits were influenced by rapidly moving currents. As time passed, the sand was metamorphosed into quartzite with joints and cleavage planes that give outcrops a step-like appearance (Fig. 4). Fossil evidence from this time period, in Iowa and the rest of the world, indicates that trilobites had not yet made their appearance on the earth's geologic scene.

Fig. 4. Typical step-like outcrop of Sioux quartzite at Gitchie Manitou, Lyon County.

The Trail Begins

During the Cambrian Period, some 600 million years ago, seas were spreading across the North American continent. It is believed that the climate was extremely warm and few mountains were present. Some think the land may have been barren and desolate. In Iowa, the Cambrian seas were shallow and the beds mostly sandstone. In a roadcut, at Firebell Hill north of Lansing, the Cambrian is represented by a green-colored, glauconitic sandstone.

Trilobites were so common during this period that the Cambrian Period is often referred to as "The Age of the Trilobites". The base of the Cambrian was defined originally as the point of lowest occurrence of the trilobite *Olenellus thompsoni*, a rather spiny trilobite with a semicircular cephalon, large crescent-shaped eyes, and a long segmented

glabella. The clastic strata of the Upper Cambrian in Iowa have few fossil remains. Some investigators have reported finding specimens of *Agnostus parelis Hall,* a very small trilobite, in the Upper Cambrian Eau Claire Foundation, downriver from Lansing, Iowa.

The Trail Continues

Iowa's Ordovician deposits were formed during a period of extended continental submergence. Arctic America was not icebound at the time and the seas spread onto the continent from both the north and the south. Representative outcrops occur at Clermont in Fayette County and Pike's Peak State Park in Clayton County. Rocky streams cutting southeast of Clermont expose the Maquoketa Formation This formation contains the trilobite, *Isotelus* (Fig. 5). *Isotelus* is con-

Fig. 5. Trilobite fossil in Maquoketa Formation.

sidered advanced in evolutionary characteristics with its smooth cephalon and pygidium, and the glabella blunt and unfurrowed. Graptolites and cephalopods are also found in these same strata.

The trail of the trilobite continues into the Silurian Periods. In Backbone State Park, in Delaware County, pronounced ridges of Niagarian dolomite of Silurian age occurs. Here, the trilobite, *Calymene,* can be found, in addition to brachipods and honeycomb and chain-type corals.

Late Devonian sediments rich in marine fauna occur at Rockford (Fig. 6), in Floyd County, where excavations of the Rockford Brick and Tile Company reveal the Juniper Hill shales which are used in the

manufacture of tile. The Cerro Gordo Member, with its alternating calcareous shales and muddy limestone deposits, provides evidence of an environment very favorable to marine life, with an abundance of fossil brachipods, bryozoans, gastropods, pelecypods, and horn corals.

Pygidia of the trilobite, *Proctus*, are found in localities associated with the Cedar Valley Limestone.

Fig. 6. Rockford Quarry exposure showing limestone and shale layers above Juniper Hill shales.

Outcrops of the Mississippian Period, found at Pella and Red Rock, have a discontinuous outcrop pattern. It was a period when seas continually inundated the land and then receded, leaving unconformities where the land rose above the water and was eroded. The fossils and rocks indicate much about the depth, temperature and clarity of the water.

In an abandoned quarry (Fig. 7) south of Pella, the Lower Pennsylvanian is exposed in the upper east wall. Here in layers of buff-colored

Fig. 7. East wall of abandoned quarry south of Pella now owned by Isaac Walton Club.

rock and black-striped shale are found fossils of land plants such as *Lepidodendron* and *Sigillaria.* Immediately below this strata is the St. Genevieve limestone which is of Mississippian age, and contains abundant fossils. The pygidia and cephalon of the trilobite, *Phillipsia,* are found here. Other fossils include brachiopods, rugose corals, crinoid stems, and bryozoans. Many fossils may be collected from Mississippian and Pennsylvanian strata in the Red Rock Lake area of south central Iowa. In addition, minerals such as dolomite, calcite, selenite, pyrite and siderite are known.

In Iowa, Lower Pennsylvanian strata were formed when the land submerged, allowing seas to flow inland (northward) over vast areas of mid-America. With their advances and retreats, swamps were repeatedly formed and buried. Heavy laden streams carried sediments to broad alluvial plains. The Pennsylvanian swamps must have been strange, silent places. Few lung-breathing animals existed at this time. The dominant land life was composed of amphibians, enormous cockroaches and giant dragonflies.

In the Stanzel area, west of Winterset (Fig. 8), red, blue-gray and gray shales, and limestones contain numerous fossils. The remains of the trilobite, *Ameura* are found in this area. *Ameura* remains are fragmentary. The cephalon of *Ameura* lacks a glabella which reaches its edge. Also in this vicinity are found the leaf imprints of the fern *Neuropteris,* as well as brachipods, crinoids, shark's teeth and fusulinids.

Fig. 8. Stanzel quarry showing an exposure of Pennsylvanian (Missouri) age.

The Trail Ends

A visit to outcrops in the Fort Dodge area will reveal gypsum beds which were formed by evaporation in an ancient sea. Some authorities believe these beds date back to the Upper Jurassic, although it was originally thought that the beds represented Permian times (the close of the Paleozoic Era). In any event, the close of the Paleozoic Era marked the decline of trilobites. Only three genera survived in Permian times.

The extinction of trilobites remains a mystery. Possibly they could no longer compete with newly-evolving forms of life and/or they could not adapt to changing environmental conditions. Nevertheless, proof of their existence remains solidified in Paleozoic rocks. In Iowa, as in the rest of the world, the trail of the trilobite begins and ends in Paleozoic sediments.

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The Meter Redefined

The current definition of the meter, based on the measurement of the wavelength of a line in the ^{86}Kr spectrum, is 10^4 times less accurate than the definition of time by the cesium "atomic clock." Scientists at the U.S. National Bureau of Standards, in collaboration with those at the National Research Council, have succeeded in linking a transition of I^2 in the visible region with the cesium primary standard in the microwave region. This is the first time such a link has been established. As a result, the next General Conference of Weights and Measures will be asked to approve the redefinition of the meter as the distance travelled by plane electromagnetic waves in $\frac{1}{299,792,458}$ parts of a second.

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Vulcanism

If you want slides of the Mount St. Helens volcanic activity, a set of 10 is available for $12.50 from Volcano, Box 180, Vancouver, Washington 98666. A newspaper account of the day-by-day events is also available for $1.00.